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Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Notice of the Office communication was sent electronically on above-indicated "Notification Date" to the following e-mail address(es):

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Office Action Summary	Application No.	Applicant(s)	
	10/679,824	RICKARD ET AL.	
	Examiner	Art Unit	
	LI LIU	2613	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE *3* MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *26 December 2007*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-59* is/are pending in the application.

4a) Of the above claim(s) *13-15,17-19,33 and 35-59* is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-12,16,20-32 and 34* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *06 October 2003* is/are: a)☐ accepted or b)☒ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date *2/17/2005*.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

DETAILED ACTION

Election/Restrictions

1. Applicant's election with traverse of species 1 (Claims 1-16, 20-32 and 34) in the reply filed on 12/26/2007 is acknowledged. The traversal is on the ground(s) that "Figure 3 operates according to the same principle and essentially multiple apparatus of Figure 2, or Figure 3 is simply an extension of Figure 2 with multiple branches in parallel"; and "Figure 5 is a second implementation of receiver for carrying out the method of the invention" and "Figure 7 is simply more detailed explanations of Figure 5".

This is not found persuasive because: in Figure 2, the modulator 294 is an "I/Q optical modulator", and "allowing an optical signal with amplitude and frequency defined by the I and Q inputs to be output", and an optional reference tone 297 may be used; and in order to receive the signal generated by the apparatus of FIG. 2, a coherent detection system is required--that is, the phase as well as the amplitude of the received signal may be detected; however, in Figure 3, each modulator 31 is a electrical I/Q modulator, and the each electrical modulator is fed with a carrier at a different frequency f1 . . . fn (the electrical carrier tone 32 is required); the output of each modulator is passed to an electrical signal combiner 33 to combine the electrical signals into a single electrical signal; this electrical signal is then passed to an optical modulator 34; and if this optical modulator is an amplitude modulator, coherent reception is not required. That is, the Figure 3 is not simply an extension or "essentially multiple apparatus" of Figure 2. Applicant cites "page 23, line 10" for supporting the argument, however, that paragraph clearly states that the part 30 of Figure 3 and the part 298 of Figure 2 are

operating in the same principle; but after that, the operation is different. The signal modulation/transmission as well as receiving is different. That is, Figures 2, 4 and 6 belong one species, and Figures 3 and 7 belong to another species. Also, a plurality of species cause a burden on the examiner.

The Examiner accepts the applicant's suggestion that method parts of the application (Figures 1, 8 and 9) are linked to the apparatus. Therefore, Figures 1, 8 and 9 have been grouped into Species 1 (Figures 2, 4, 6 and Figures1, 8 and 9); and the Figures 1, 8 and 9 are also incorporated into other non-elected species, respectively.

2. The applicant elects species 1 and claims 1-16, 20-32 and 34. But, the claim 13, and thus depending claims 14 and 15, belong to Figure 3, that is, the claims 13-15 are drawn to another species (Figure 3). Therefore, the claims 13-15 are withdrawn from further consideration as being drawn to nonelected species. During a telephone conversation with William W. Lee on 03/21/2008, the examiner informed the applicant of the withdrawal of claims 13-15, the applicant does not have an objection.

3. Claims 13-15, 17-19, 33, 35-58 are withdrawn from further consideration pursuant to 37 CFR 1.142(b) as being drawn to a nonelected species, there being no allowable generic or linking claim.

The requirement is still deemed proper and is therefore made FINAL.

Information Disclosure Statement

4. The information disclosure statement (IDS) submitted on 02/17/2005 is being considered by the examiner.

Drawings

5. The drawings are objected to because there are no labels for block 21, 25, 28, 293 and 294 in Figure 2, and 31, 33 etc. in Figures 4-7. These blocks need to have descriptive labels under 37 CFR 1.84(n) and 1.84(o). For example, “FFT” may be used for the label of block 25 in Figure 2, and “De-Serialiser" for the label of block 64 in Figure 6.

6. The drawings are objected to under 37 CFR 1.83(a). The drawings must show every feature of the invention specified in the claims. Therefore, the “two Mach-Zehnder structures, connected to an optical combiner” claimed in claim 12 and “optical coupler” and “optical local oscillator” claimed in claim 31 must be shown or the feature(s) canceled from the claim(s). No new matter should be entered.

Corrected drawing sheets in compliance with 37 CFR 1.121(d) are required in reply to the Office action to avoid abandonment of the application. Any amended replacement drawing sheet should include all of the figures appearing on the immediate prior version of the sheet, even if only one figure is being amended. The figure or figure number of an amended drawing should not be labeled as “amended.” If a drawing figure is to be canceled, the appropriate figure must be removed from the replacement sheet, and where necessary, the remaining figures must be renumbered and appropriate changes made to the brief description of the several views of the drawings for consistency. Additional replacement sheets may be necessary to show the renumbering of the remaining figures. Each drawing sheet submitted after the filing date of an

application must be labeled in the top margin as either "Replacement Sheet" or "New Sheet" pursuant to 37 CFR 1.121(d). If the changes are not accepted by the examiner, the applicant will be notified and informed of any required corrective action in the next Office action. The objection to the drawings will not be held in abeyance.

Claim Rejections - 35 USC § 102

7. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

8. Claims 22 and 27 are rejected under 35 U.S.C. 102(b) as being anticipated by Dolgonos et al (US 2002/0137464).

1). With regard to claim 22, Dolgonos et al discloses an apparatus for receiving an optical sub-carrier multiplexed signal (e.g., Figures 4-7), the apparatus comprising

an optical to electrical converter (the O/E transducer 21(i) in Figures 4-7), in use receiving the optical sub-carrier multiplexed signal ([0021], [[0026], [0027] [0034] and [0044] etc.) and outputting an electrical signal, and

a digital signal processor (e.g., 58-68 in Figures 4-7) having an electrical input, in use receiving the output of the optical to electrical converter, and a plurality of electrical outputs (the output from the DFT are parallel signals), in use each carrying a signal representing data carried on a sub-carrier of the optical sub-carrier multiplexed signal,

wherein, the outputs of the digital signal processor are the result of a Fourier transform performed on the input signal (the DFT in Figure 4 performs Fourier transform).

2). With regard to claim 27, Dolgonos et al discloses the digital signal processor comprising

a de-serialiser (e.g., the S/P 65 in Figures 4-7) having an electrical input receiving the output of the optical to electrical converter (the S/P receives the electrical signal) and outputting a plurality of signals obtained by the deserialisation of the input (the outputs from the S/P are parallel signals),

a Fourier transform unit (e.g., DFT in Figures 4-7) having a plurality of electrical inputs, in use receiving the outputs of the de-serialiser, and a plurality of electrical outputs, in use each carrying a signal representing data carried on a sub-carrier of the optical sub-carrier multiplexed signal,

wherein the electrical outputs of the Fourier transform unit are the result of a Fourier transform performed on the inputs (Figures 4-7, the outputs from the DFT are the result of a Fourier transform performed on the inputs).

Claim Rejections - 35 USC § 103

9. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

10. Claims 1, 3-6, 8, 9, 16, 22, 23, 27, 28 and 34 are rejected under 35 U.S.C. 103(a) as being unpatentable over Smart et al (US 2002/0041637).

1). With regard to claims 1 and 20, Smart et al discloses an apparatus/optical transmitter for generating an optical sub-carrier multiplexed signal (e.g., 311 in Figure 3B, and Figure 9 and 14), comprising

a digital signal processor (e.g., the IFFT 321 and P/S converter 331 in Figure 3B) having a plurality of electrical inputs, in use each receiving an input signal representing data to be carried on a sub-carrier of the optical sub-carrier multiplexed signal (Figures 2 and 3A, [0028] and [0073] etc.), and an electrical output outputting an output signal (the output from the P/S or D/A converter in Figure 3B), and

wherein the output signal of the digital signal processor is the result of a Fourier transform performed on the input signals (Figure 3B, the IFFT performs the Fourier transform).

But, in Figure 3B, Smart does not expressly show a modulator having an electrical input, in use receiving the output signal from the digital signal processor, and an optical output, in use outputting the optical sub-carrier multiplexed signal.

However, as disclosed by Smart, [0074], the multi-channel medium 112 can be an optical fiber, an optical propagation path, etc., therefore, for the optical transmission via the optical fiber or optical propagation path, it is either obvious to one skilled in the art or inherent that an optical source and modulator (or a directly modulated laser source) must be used in the system for receiving the output signal from the D/A, and

outputting the optical sub-carrier multiplexed signal), so that the SCM signals can be transmitted in the optical fiber or optical transmission path.

2). With regard to claim 3, Smart et al discloses all of the subject matter as applied to claim 1 above. And Smart et al further discloses a mapper (e.g., 1403 in Figure 14) having an electrical input, in use receiving binary data, and a plurality of electrical outputs connected to the electrical inputs of the digital signal processor, wherein the signals carried by the outputs are a representation of the binary data according to a predetermined modulation format.

3). With regard to claim 4, Smart et al discloses all of the subject matter as applied to claims 1 and 3 above. And Smart et al further discloses where the predetermined modulation format is a phase modulation format ([0022] and [0083]).

4). With regard to claim 5, Smart et al discloses all of the subject matter as applied to claims 1 and 3 above. And Smart et al further discloses where the predetermined modulation format is a differential phase modulation format ([0022] and [0083], and claim 20).

5). With regard to claim 6, Smart et al discloses all of the subject matter as applied to claims 1 and 3 above. And Smart et al further discloses where the predetermined modulation format is an amplitude modulation format ([0022] and [0083]).

6). With regard to claim 8, Smart et al discloses all of the subject matter as applied to claim 1 above. And Smart et al further discloses the digital signal processor further comprising a serialiser (e.g., P/S 331 in Figure 3B), having a plurality of electrical

inputs connected to the electrical outputs of the digital signal processor, and an electrical output in use carrying a signal generated by the serialisation of the signals carried on the plurality of electrical inputs to the serialiser.

7). With regard to claim 9, Smart et al discloses all of the subject matter as applied to claim 1 above. And Smart et al further discloses a digital to analogue converter (the D/A in Figure 3B) having an electrical input connected to the electrical output of the digital signal processor, and an electrical output connected to the modulator (for optical transmission, an optical source and modulator (or a directly modulated laser source) must be used in the system), in use the output of the digital to analogue converter being an analogue representation of the digital input signal.

8). With regard to claim 16, Smart et al discloses all of the subject matter as applied to claim 1 above. And Smart et al further discloses a forward error correction coder (e.g., the FEC 1402 and 1412 in Figure 14) connected to the digital signal processor, in use applying forward error correction coding to the data.

9). With regard to claims 22 and 34, Smart et al discloses an apparatus/receiver for receiving an optical sub-carrier multiplexed signal (e.g., 313 in Figure 3B, and Figure 9), the apparatus comprising

an A/D converter (323 in Figuer 3B), in use receiving the sub-carrier multiplexed signal and outputting an electrical signal, and

a digital signal processor (e.g., the P/S 332 and IFFT 334 etc in Figure 3B) having an electrical input, in use receiving the output of the optical to electrical

converter, and a plurality of electrical outputs, in use each carrying a signal representing data carried on a sub-carrier of the optical sub-carrier multiplexed signal,

wherein, the outputs of the digital signal processor are the result of a Fourier transform performed on the input signal (the IFFT 324 performs the Fourier transform on the input signal).

But, in Figure 3B, Smart et al does not expressly show an optical to electrical converter, in use receiving the optical sub-carrier multiplexed signal. However, as disclosed by Smart, [0074], the multi-channel medium 112 can be an optical fiber, an optical propagation path, etc., therefore, for the optical transmission via the optical fiber or optical propagation path, it is either obvious to one skilled in the art or inherent that an optical to electrical converter must be used in the system to convert the optical signal to electrical signal and then to the A/D converter 323, and outputting the electrical signal, so that the optical communication can be utilized, and the SCM signals can be received via the optical fiber or optical transmission path.

10). With regard to claim 23, Smart et al discloses all of the subject matter as applied to claim 22 above. And Smart et al further discloses a decoder ([0086], the FFT also perform the decoding) having a plurality of electrical inputs in use receiving the outputs of the digital signal processor, and an electrical output, in use outputting binary data (also, Figure 15 shows the decoders 1512 and 1522).

11). With regard to claim 27, Smart et al discloses all of the subject matter as applied to claim 22 above. And Smart et al further discloses the digital signal processor comprising

a de-serialiser (Figure 3B, P/S 332) having an electrical input receiving the output of the optical to electrical converter and outputting a plurality of signals obtained by the deserialisation of the input,

a Fourier transform unit (the IFFT in Figure 3B) having a plurality of electrical inputs, in use receiving the outputs of the de-serialiser, and a plurality of electrical outputs, in use each carrying a signal representing data carried on a sub-carrier of the optical sub-carrier multiplexed signal,

wherein the electrical outputs of the Fourier transform unit are the result of a Fourier transform performed on the inputs (the IFFT performs the Fourier transform on the inputs).

12). With regard to claim 28, Smart et al discloses all of the subject matter as applied to claim 22 above. And Smart et al further discloses a forward error correction decoder connected to the digital signal processor, in use performing error correction on the data ([0082], the demodulator 325 demodulates the carriers to extract the output data; and other conventional operations, such as framing, blocking, and error correction can also be provided).

11. Claims 2, 21 and 26 are rejected under 35 U.S.C. 103(a) as being unpatentable over Smart et al (US 2002/0041637) in view of Sandell et al (US 2004/0131011).

1). With regard to claims 2 and 21, Smart et al discloses all of the subject matter as applied to claims 1 and 20 above. But, Smart et al does not expressly disclose where the spacing of the sub-carriers in the sub-carrier multiplexed signal is substantially equal to an integer multiple of 1/(Symbol period).

However, the OFDM is used in Smart's system, and Sandell et al teaches that the subcarriers are orthogonal if they are spaced apart in frequency by an interval of 1/T, where T is the OFDM symbol period. Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to apply the sub-carrier spacing as taught by Sandell et al to the system of Smart et al so that the sub-carrier signals are orthogonal and interferences can be reduced.

2). With regard to claim 26, Smart et al discloses all of the subject matter as applied to claim 22 above. But, Smart et al does not expressly disclose wherein the decoder comprises a maximum likelihood sequence estimation decoder.

However, as disclosed by Sandell the maximum likelihood sequence estimation (MLSE) is the conventional channel estimation technique ([0019]), in which a most probable received sequence is chosen from a set of all possible received sequences. MLSE decoding can incorporate detailed knowledge of the statistical properties of noise and crosstalk and other channels parameters into the decision process, therefore improving performance in the presence of these impairments.

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to apply the MLSE technique as widely used in the art to the system of Smart et al so that the decoder can efficiently and accurately decode the signals in the present interferences.

12. Claims 7, 11 and 12 are rejected under 35 U.S.C. 103(a) as being unpatentable over Smart et al (US 2002/0041637) as applied to claim 1 and 3 above, and in further view of Ono et al (US 6,388,786) and Dodds (US 6,259,836).

Smart et al discloses all of the subject matter as applied to claims 1 and 3 above. But, Smart et al does not expressly disclose where the predeteremined modulation format is an amplitude and phase modulation format, or the modulator is configured to modulate the amplitude and phase of an optical carrier; and wherein the modulator comprises two Mach-Zehnder structures, connected to an optical combiner.

However, Ono et al teaches a modulator that modulates the amplitude and phase of an optical carrier (e.g., Figures 8, 13, 15, 17 and 22); in Figure 22, two Mach-Zehnder structures are used for mplitude and phase modulations, and connected to an optical combiner. And another prior art, Dodds, also teaches a modulator in that two M-Z modulators are used for both amplitude modulation and phase modulation.

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to apply the amplitude and phase modulation structure as taught by Ono and Dodds to the system of Smart et al so that the I and O signals in the OFDM signals are used to modulate the intensity and phase modulators, respectively, and then detected coherently at the receiver, and transmission capacity and quality can be improved.

13. Claim 10 is rejected under 35 U.S.C. 103(a) as being unpatentable over Smart et al as applied to claim 1 above, and in further view of Sandell et al (US 2004/0131011) and Fee (US 2004/0223759).

Smart et al discloses all of the subject matter as applied to claim 1 above. But, Smart does not expressly an electrical signal generator, connected to an input of the

modulator, wherein a small depth modulation is imparted on the optical sub-carrier multiplexed output signal.

However, to insert a reference signal or pilot signal to the SCM signal is well known in the art. Sandell et al teaches a electrical signal generator to generate a pilot signal for determining a channel estimate (amplitude change and phase shift etc.) ([008], [0026] and [0030]). But, Sandell et al does not expressly state wherein a small depth modulation is imparted on the optical sub-carrier multiplexed output signal.

Fee, in the same field of endeavor, teaches a monitoring signal with a small depth modulation imparted on the optical carrier output signal (Figures 6-9). By monitor the modulation tone or the superimposed signal, the signal transmission quality can be deduced and monitored.

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to apply the reference signal as taught by Sandell et al and Fee to the system of Smart et al so that the channel estimation can be readily determined.

14. Claims 24, 25, 29 and 30 are rejected under 35 U.S.C. 103(a) as being unpatentable over Smart et al as applied to claim 22 above, and in view of Maltsev et al (US 7,286,609).

1). With regard to claims 24 and 25, Smart et al discloses all of the subject matter as applied to claim 22 above. But, Smart et al does not expressly state that the decoder comprising a serialiser having a plurality of inputs receiving the outputs of the digital signal processor, and an output outputting a signal derived by the serialisation of the

input signals; and wherein the output data is determined by the comparison of the input signals with a predetermined value.

However, Maltsev et al, in same field of endeavor, teaches a SCM transmission system and method that comprises a decoder (e.g., Decoder 230 and P/S 232 in Figure 2) having a plurality of electrical inputs in use receiving the outputs of the digital signal processor and an electrical output (the output 234 in Figure 2), in use outputting binary data (the output 234 in Figure 2); and the decoder comprising a serialiser (e.g., the P/S transform block 232 in Figure 2) having a plurality of inputs receiving the outputs of the digital signal processor, and an output outputting a signal (the signal 234 in Figure 2) derived by the serialisation of the input signals; and the output data is determined by the comparison of the input signals with a predetermined value (column 5, line 48-53, column 7, line 31-32, column 8 line 22-42, column 11 line 8, and column 13 line 52-54).

Maltsev et al provides high throughput and reduced interference and less expensive system. Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to apply the receiver structure as taught by Maltsev et al to the system of Smart et al so that a high quality and less expensive receiver can be utilized.

2). With regard to claims 29 and 30, Smart et al discloses all of the subject matter as applied to claim 22 above. But, Smart et al does not expressly disclose the apparatus further comprising apparatus to determine channel state information of the sub-carriers; and wherein the channel state information is utilised by the forward error correction decoder to improve the performance of the error correction.

However, Maltsev et al teaches an apparatus that determines channel state information of the sub-carriers (Figure 2, the channel state information 236 is provided to the SMA 202); and the channel state information is utilised by the forward error correction decoder to improve the performance of the error correction (column 5, line 15-49, and column 2, line 1-24, the SMA controls the decoding of individual ones of the received subcarrier based on the CSI etc.)

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to apply the channel state information as taught by Maltsev et al to the system of Smart et al so that the decoder can efficiently and accurately decode the signals based on the channel state information etc.

15. Claim 31 is rejected under 35 U.S.C. 103(a) as being unpatentable over Smart et al as applied to claim 22 above and in further view of Watanabe (US 5,896,211).

Smart et al discloses all of the subject matter as applied to claim 22 above. But, Smart et al does not expressly disclose the apparatus further comprising an optical coupler, having a plurality of optical inputs, in use one of said inputs receiving the optical sub-carrier multiplexed signal, and another of said inputs receiving the output of an optical local oscillator, and a plurality of optical outputs, at least one of said outputs being connected to the optical to electrical converter.

However, to use a local oscillator for coherent detection is well known in the art. Watanabe discloses such a system in which an optical coupler (e.g., the optical mixer 46 in Figure 17), having a plurality of optical inputs, in use one of said inputs receiving the optical sub-carrier multiplexed signal (Figure 17, one input receives the optical sub-

carrier multiplexed signal), and another of said inputs receiving the output of an optical local oscillator signal (Figure 17, one input receives the optical local oscillator signal 45), and a plurality of optical outputs, at least one of said outputs being connected to the optical to electrical converter (e.g., one output being connected to the optical to electrical converter 48 in Figure 17).

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to apply a local optical oscillator as taught by Watanabe to the system of Smart et al so that a coherent detection can be obtained and the phase and amplitude information in the SCM signals can be detected.

16. Claim 32 are rejected under 35 U.S.C. 103(a) as being unpatentable over Smart et al as applied to claim 22 above and in further view of Shpantzer et al (US 2002/0186435).

Smart et al discloses all of the subject matter as applied to claim 22 above. But, Smart et al does not expressly disclose the apparatus comprising an optical demultiplexer having an optical input in use receiving the plurality of optical sub-carrier multiplexed signals, and a plurality of optical outputs in use each output carrying at least one of the optical sub-carrier multiplexed signals, wherein the outputs are connected to apparatus.

However, to use a demultiplexer to demultiplex a WDM signal is a widely practice in the art. Shpantzer et al teaches such a system for OFDM optical communications; and the demultiplexer (e.g., the Demux 230 in Figure 2a) having an optical input in use receiving the plurality of optical sub-carrier multiplexed signals (Figure 2), and a plurality

of optical outputs (the outputs from the Demux in Fiugre 2) in use each output carrying at least one of the optical sub-carrier multiplexed signals, wherein the outputs are connected to receivers.

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to apply a WDM demultiplexer as widely used in the art to the system of Smart et al so that the WDM demultplexer is connected to a plurality receiver to receive the multiple optical sub-carrier multiplexed signals and then system capacity can be increased.

17. Claims 1-12 are rejected under 35 U.S.C. 103(a) as being unpatentable over Dolgonos et al (US 2002/0137464) in view of Panzeri (US 2005/0231783) and Watanabe (US 5,896,211).

1). With regard to claims 1 and 20, Dolgonos et al discloses an apparatus/transmitter (e.g., Figure 2) for generating a sub-carrier multiplexed signal, comprising

a digital signal processor (e.g., the IDFT 36 and P/S 38 and D/A 42 in Figure 2) having a plurality of electrical inputs (the parallel electrical signals from S/P 34 in Figure 2), in use each receiving an input signal representing data ([0021]), and an electrical output outputting an output signal (the output from the D/A 42 in Figure 2), and

a modulator (e.g., the RF TX 44 in Figure 2) having an electrical input, in use receiving the output signal from the digital signal processor in use outputting multiplexed signal ([0022]),

wherein the output signal of the digital signal processor (e.g., the IDFT 36 and P/S 38 and D/A 42 in Figure 2) is the result of a Fourier transform performed on the input signals (the IDFT 36 performs the Fourier transform on the input signals).

But, Dolgonos et al does not expressly disclose that the apparatus is an optical transmitter and generates an optical sub-carrier multiplexed signal; and the data is carried on a sub-carrier of the optical sub-carrier multiplexed signal; and the modulator is an optical modulator and output the optical sub-carrier multiplexed signal.

Dolgonos et al teaches that the link between the base station and the hub is the optical fiber; and the transducer 52 modulates the OFDM symbols onto a light beam for transmission over the fiber link.

Panzeri teaches a system and method for free space optical communications in which an optical sub-carrier multiplexed signal (Figures 1 and 3) is generated, and the OFDM signals (I/Q) are carried on a sub-carrier of the optical sub-carrier multiplexed signal, and the modulator is an optical modulator (LD in Figures 1 and 3 is a direct modulated laser, [0043]-[0045]) and output the optical sub-carrier multiplexed signal.

Another prior art, Watanabe et al, in the same field of endeavor, also teaches an SCM (subcarrier multiplexed) optical communication system (e.g., Figures 3-6 and 10-24).

By optical carrier, the system capacity and transmission speed can be substantially increased, therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to combine the optical transmission techniques as taught by Panzeri and Watanabe et al with the system of Dolgonos et al

so that a SCM optical communication system, suitable for communications between a mobile or fixed station and another stations, with high speed and high capacity and low noise can be obtained.

2). With regard to claims 2 and 21, Dolgonos et al and Panzeri and Watanabe et al disclose all of the subject matter as applied to claim 1 above. And Dolgonos et al further discloses where the spacing of the sub-carriers in the sub-carrier multiplexed signal is substantially equal to an integer multiple of 1/(Symbol period) (the orthogonal frequency division modulation OFDM is used in the communications, to be "orthogonal", it is necessary that the spacing of the sub-carriers in the sub-carrier multiplexed signal is substantially equal to an integer multiple of 1/(Symbol period), [0002]).

3). With regard to claim 3, Dolgonos et al and Panzeri and Watanabe et al disclose all of the subject matter as applied to claim 1 above. And Dolgonos et al further discloses the apparatus further comprising a mapper having an electrical input, in use receiving binary data, and a plurality of electrical outputs connected to the electrical inputs of the digital signal processor, wherein the signals carried by the outputs are a representation of the binary data according to a predetermined modulation format ([0021], the coding block 32 receives the data stream and introduces redundancy for forward error correction coding and **constellation maps** the data stream).

4). With regard to claim 4, Dolgonos et al and Panzeri and Watanabe et al disclose all of the subject matter as applied to claims 1 and 3. And Dolgonos et al

further discloses where the predetermined modulation format is a phase modulation format ([0021], e.g., the QPSK).

5). With regard to claim 6, Dolgonos et al and Panzeri and Watanabe et al disclose all of the subject matter as applied to claims 1 and 3 above. And Dolgonos et al and Panzeri and Watanabe et al further disclose where the predetermined modulation format is an amplitude modulation format (e.g., QAM in Dolgonos, or [0043] in Panzeri; or column 12 line 48-55 of Watanabe et al).

6). With regard to claim 8, Dolgonos et al and Panzeri and Watanabe et al disclose all of the subject matter as applied to claim 1 above. And Dolgonos et al further discloses the digital signal processor further comprising a serialiser (e.g., P/S 38 in Figure 2), having a plurality of electrical inputs connected to the electrical outputs of the digital signal processor, and an electrical output in use carrying a signal generated by the serialisation of the signals carried on the plurality of electrical inputs to the serialiser.

7). With regard to claim 9, Dolgonos et al and Panzeri and Watanabe et al disclose all of the subject matter as applied to claim 1 above. And Dolgonos et al further discloses the apparatus comprising a digital to analogue converter (the D/A 42 in Figuer 2) having an electrical input connected to the electrical output of the digital signal processor, and an electrical output connected to the modulator, in use the output of the digital to analogue converter being an analogue representation of the digital input signal.

8). With regard to claim 16, Dolgonos et al and Panzeri and Watanabe et al disclose all of the subject matter as applied to claim 1 above. And Dolgonos et al further

discloses a forward error correction coder (the Coder 32 in Figure 2, [0021]) connected to the digital signal processor, in use applying forward error correction coding to the data.

18. Claim 5 is rejected under 35 U.S.C. 103(a) as being unpatentable over Dolgonos et al and Panzeri and Watanabe et al as applied to claim 1 and 3 above, and in further view of Way et al (US 6,525,857).

Dolgonos et al and Panzeri and Watanabe et al disclose all of the subject matter as applied to claim 1 above. And Dolgonos et al does not expressly discloses where the predetermined modulation format is a differential phase modulation format. However, the DPSK is widely used modulation format in the art. Way et al uses the DPSK format for SCM optical transmission system (column 4, line 38-46). Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to use the DPSK modulation format in the system of Dolgonos et al.

19. Claims 7, 11 and 12 are rejected under 35 U.S.C. 103(a) as being unpatentable over Dolgonos et al and Panzeri and Watanabe et al as applied to claim 1 and 3 above, and in further view of Ono et al (US 6,388,786) and Dodds (US 6,259,836).

Dolgonos et al and Panzeri and Watanabe et al disclose all of the subject matter as applied to claims 1 and 3 above. But, Dolgonos et al does not expressly disclose where the predeteremined modulation format is an amplitude and phase modulation format, or the modulator is configured to modulate the amplitude and phase of an

optical carrier; and wherein the modulator comprises two Mach-Zehnder structures, connected to an optical combiner.

However, Ono et al teaches a modulator that modulates the amplitude and phase of an optical carrier (e.g., Figures 8, 13, 15, 17 and 22); in Figure 22, two Mach-Zehnder structures are used for mplitude and phase modulations, and connected to an optical combiner. And another prior art, Dodds, also teaches a modulator in that two M-Z modulators are used for both amplitude modulation and phase modulation.

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to apply the amplitude and phase modulation structure as taught by Ono and Dodds to the system of Dolgonos et al so that the I and O signals in the OFDM signals are used to modulate the intensity and phase modulators, respectively, and then detected coherently at the receiver, and transmission capacity and quality can be improved.

20. Claim 10 is rejected under 35 U.S.C. 103(a) as being unpatentable over Dolgonos et and Panzeri(US 2005/0231783) and Watanabe (US 5,896,211) as applied to claim 1 above, and in further view of Sandell et al (US 2004/0131011) and Fee (US 2004/0223759).

Dolgonos et al and Panzeri and Watanabe et al disclose all of the subject matter as applied to claim 1 above. But, Dolgonos does not expressly an electrical signal generator, connected to an input of the modulator, wherein a small depth modulation is imparted on the optical sub-carrier multiplexed output signal.

In Dolgonos et al's system, the reference signal is provided externally (e.g., 80 in Figure 2, and 94 in Figures 5 and 7) so to coordinate the transmission and receiving.

However, to insert a reference signal or pilot signal to the SCM signal is well known in the art. Sandell et al teaches a electrical signal generator to generate a pilot signal for determining a channel estimate (amplitude change and phase shift etc.) ([008], [0026] and [0030]). But, Sandell et al does not expressly state wherein a small depth modulation is imparted on the optical sub-carrier multiplexed output signal.

Fee, in the same field of endeavor, teaches a monitoring signal with a small depth modulation imparted on the optical carrier output signal (Figures 6-9). By monitor the modulation tone or the superimposed signal, the signal transmission quality can be deduced and monitored.

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to apply the reference signal as taught by Sandellet al and Fee to the system of Dolgonos et al and Panzeri and Watanabe et al so that the channel estimation can be readily determined.

21. Claim 28 is rejected under 35 U.S.C. 103(a) as being unpatentable over Dolgonos et al.

Dolgonos et al discloses all of the subject matter as applied to claim 22 above. And Dolgonos et al discloses a decoder (e.g, the Decoder 74 in Figures 4-7) connected to the digital signal processor, in use performing error correction on the data. But, Dolgonos et al does not expressly state that the decoder is a forward error correction decoder.

However, as disclosed by Dolgonos et al, in transmitter, the Coder 32 is “for forward error correction coding” etc., therefore, it is obvious to one skilled in the art that the corresponding Decoder 74 is also for forward error correction, in use performing error correction on the data so that the coded signal by the FEC in transmitter can be decoded in the receiver.

22. Claims 23-25, 29 and 30 are rejected under 35 U.S.C. 103(a) as being unpatentable over Dolgonos et al as applied to claim 22 above, and in view of Maltsev et al (US 7,286,609).

1). With regard to claims 23 and 24, Dolgonos et al discloses all of the subject matter as applied to claim 22 above. And Dolgonos et al further discloses the apparatus further comprising a decoder (e.g., Decoder 74 in Figures 4-7) having a plurality of electrical inputs in use receiving the outputs of the digital signal processor and electrical outputs, in use outputting binary data; and the decoder comprising a serialiser (e.g., the P/S 70 in Figures 4-7) having a plurality of inputs receiving the outputs of the digital signal processor, and an output outputting a signal derived by the serialisation of the input signals.

But, in the system of Dolgonos et al (Figure 4-7), the decoder is after the Parallel/Serial converter. However, Maltsev et al teaches a SCM transmission system and method that comprises a decoder (e.g., Decoder 230 and P/S 232 in Figure 2) having a plurality of electrical inputs in use receiving the outputs of the digital signal processor and an electrical output (the output 234 in Figure 2), in use outputting binary data (the output 234 in Figure 2); and the decoder comprising a serialiser (e.g., the P/S

transform block 232 in Figure 2) having a plurality of inputs receiving the outputs of the digital signal processor, and an output outputting a signal (the signal 234 in Figure 2) derived by the serialisation of the input signals.

Maltsev et al provides high throughput and reduced interference and less expensive system. Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to apply the receiver structure as taught by Maltsev et al to the system of Dolgonos et al so that a high quality and less expensive receiver can be utilized.

2). With regard to claim 25, Dolgonos et al and Maltsev et al disclose all of the subject matter as applied to claims 22 and 23 above. And Dolgonos et al further discloses wherein the output data is determined by the comparison of the input signals with a predetermined value ([0071] and [0078] and claim 31).

3). With regard to claims 29 and 30, Dolgonos et al discloses all of the subject matter as applied to claims 22 and 28 above. But, Dolgonos et al does not expressly disclose the apparatus further comprising apparatus to determine channel state information of the sub-carriers; and wherein the channel state information is utilised by the forward error correction decoder to improve the performance of the error correction.

However, Maltsev et al teaches an apparatus that determines channel state information of the sub-carriers (Figure 2, the channel state information 236 is provided to the SMA 202); and the channel state information is utilised by the forward error correction decoder to improve the performance of the error correction (column 5, line

15-49, and column 2, line 1-24, the SMA controls the decoding of individual ones of the received subcarrier based on the CSI etc.)

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to apply the channel state information as taught by Maltsev et al to the system of Dolgonos et al so that the decoder can efficiently and accurately decode the signals based on the channel state information etc.

23. Claim 26 is rejected under 35 U.S.C. 103(a) as being unpatentable over Dolgonos et al and Maltsev et al as applied to claims 22 and 23 above, and in view of Sandell (US 2004/0131011).

Dolgonos et al and Maltsev et al disclose all of the subject matter as applied to claims 22 and 23 above. But, Dolgonos et al and Maltsev et al do not expressly disclose wherein the decoder comprises a maximum likelihood sequence estimation decoder.

However, as disclosed by Sandell the maximum likelihood sequence estimation (MLSE) is the conventional channel estimation technique ([0019]), in which a most probable received sequence is chosen from a set of all possible received sequences. MLSE decoding can incorporate detailed knowledge of the statistical properties of noise and crosstalk and other channels parameters into the decision process, therefore improving performance in the presence of these impairments.

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to apply the MLSE technique as widely used in the art to the system of Dolgonos et al and Maltsev et al so that the decoder can efficiently and accurately decode the signals in the present interferences.

24. Claim 31 is rejected under 35 U.S.C. 103(a) as being unpatentable over Dolgonos et al (US 2002/0137464) as applied to claim 22 above and in further view of Watanabe (US 5,896,211).

Dolgonos et al discloses all of the subject matter as applied to claim 22 above. But, Dolgonos et al does not expressly disclose (A) the apparatus further comprising an optical coupler, having a plurality of optical inputs, in use one of said inputs receiving the optical sub-carrier multiplexed signal, and another of said inputs receiving the output of an optical local oscillator, and a plurality of optical outputs, at least one of said outputs being connected to the optical to electrical converter.

With regard to item (A), however, to use a local oscillator for coherent detection is well known in the art. Watanabe discloses such a system in which an optical coupler (e.g., the optical mixer 46 in Figure 17), having a plurality of optical inputs, in use one of said inputs receiving the optical sub-carrier multiplexed signal (Figure 17, one input receives the optical sub-carrier multiplexed signal), and another of said inputs receiving the output of an optical local oscillator signal (Figure 17, one input receives the optical local oscillator signal 45), and a plurality of optical outputs, at least one of said outputs being connected to the optical to electrical converter (e.g., one output being connected to the optical to electrical converter 48 in Figure 17).

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to apply a local optical oscillator as taught by Watanabe to the system of Dolgonos et al so that a coherent detection can be obtained and the phase and amplitude information in the SCM signals can be detected.

25. Claim 32 are rejected under 35 U.S.C. 103(a) as being unpatentable over Dolgonos et al (US 2002/0137464) as applied to claim 22 above and in further view of Shpantzer et al (US 2002/0186435).

Dolgonos et al discloses all of the subject matter as applied to claim 22 above. But, Dolgonos et al does not expressly disclose the apparatus comprising an optical demultiplexer having an optical input in use receiving the plurality of optical sub-carrier multiplexed signals, and a plurality of optical outputs in use each output carrying at least one of the optical sub-carrier multiplexed signals, wherein the outputs are connected to apparatus.

However, to use a demultiplexer to demultiplex a WDM signal is a widely practice in the art. Shpantzer et al teaches such a system for OFDM optical communications; and the demultiplexer (e.g., the Demux 230 in Figure 2a) having an optical input in use receiving the plurality of optical sub-carrier multiplexed signals (Figure 2), and a plurality of optical outputs (the outputs from the Demux in Fiugre 2) in use each output carrying at least one of the optical sub-carrier multiplexed signals, wherein the outputs are connected to receivers.

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to apply a WDM demultiplexer as widely used in the art to the system of Dolgonos et al so that the WDM demultplexer is connected to a plurality receiver to receive the multiple optical sub-carrier multiplexed signals and then system capacity can be increased.

Conclusion

26. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure.

Ring (US 6,430,148);

Sadri et al (US 2005/0032514);

Frodigh et al (US 5,726,978);

Harada et al (US 2002/0126774);

Borran et al (US 2004/0264585);

Puc (US 6,341,023);

Agazzi (US 6,879,640)

27. Any inquiry concerning this communication or earlier communications from the examiner should be directed to LI LIU whose telephone number is (571)270-1084. The examiner can normally be reached on Mon-Fri, 8:00 am - 5:30 pm, alternating Fri off.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Ken Vanderpuye can be reached on (571)272-3078. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

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Li Liu
March 22, 2008

/Kenneth N Vanderpuye/
Supervisory Patent
Examiner, Art Unit 2613